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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/721,932	11/25/2003	K.R. Udayakumar	TI 35507	8320
23494	7590	03/06/2006	EXAMINER	
TEXAS INSTRUMENTS INCORPORATED P O BOX 655474, M/S 3999 DALLAS, TX 75265			VINH, LAN	
			ART UNIT	PAPER NUMBER
			1765	

DATE MAILED: 03/06/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/721,932

Applicant(s)

UDAYAKUMAR ET AL.

Examiner

Lan Vinh

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 19 December 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-25 is/are pending in the application.
- 4a) Of the above claim(s) 22-25 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-5, 7-15 and 17-21 is/are rejected.
- 7) ☒ Claim(s) 6 and 16 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-4, 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yang et al (US 6,162,583) in view of Song et al (US 6,713,310) and further in view of Tomioka et al (US 5,897,713)

Yang discloses a method for making intermetal dielectric on semiconductor device.

The method comprises the steps of:

providing a substrate 20 having an etch stop layer 18 (SiN) located thereunder (col 5, lines 55-65; fig. 6)

etching an opening in the substrate using an etchant comprising a carbon oxide, CF<sub>4</sub>/fluorocarbon, oxygen/an etch rate modulator and an inert carrier gas (col 4, lines 4-10), the etchant does not etch layer 18 (fig. 6), which reads on the etchant is selective to the layer 18/etch stop layer

Unlike the instant claimed invention as per claim 1, Yang fails to expressly disclose using an aluminum oxide etch stop layer

Song discloses a method for forming a semiconductor device comprises the step of forming an etch stop layer of SiN, aluminum oxide (col 4, lines 22-24)

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One skilled in the art at the time the invention was made would have found it obvious to modify Yang method by forming an aluminum oxide etch stop layer as per Song because Song discloses that the etch stop layer is preferably made of an aluminum oxide layer, a SiN layer (col 4, lines 20-22)

Yang also fails to specifically disclose that the flow rate of the carbon oxide is greater than about 80 sccm

Tomioka discloses a method for generating plasma used for etching comprises the step of using a mixture of fluorocarbon and carbon oxide (flow rate 200 sccm) (col 16, lines 25-27)

Since Yang is concerned with the step of etching substrate/layer 20 of oxide, one skilled in the art at the time the invention was made would have found it obvious to modify Yang method by using an etching mixture of fluorocarbon and carbon oxide having the flow rate as per Tomioka because Tomioka discloses that a gas mixture of fluorocarbon and CO (flow rate 200 sccm) is used as the etching gas for oxide film etching (col 16, lines 22-26)

The limitations of claims 2-4, 8-9 have been discussed above

Regarding claim 10, Yang discloses forming a semiconductor device by etching the via hole (col 5, lines 1-2)

3. Claims 11-14, 18-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yang et al (US 6,162,583) in view of Song et al (US 6,713,310) and further in view of Tomioka et al (US 5,897,713)

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Yang discloses a method for making intermetal dielectric on semiconductor device.

The method comprises the steps of:

providing a semiconductor devices over a substrate 12 ( fig. 6)

providing a dielectric layer 20 over the semiconductor devices, the layer 20 having an etch stop layer 18 located thereunder (col 5, lines 55-65; fig. 6)

etching an opening in the layer 20 using an etchant comprising a carbon oxide, CF<sub>4</sub>/fluorocarbon, oxygen/an etch rate modulator and an inert carrier gas (col 4, lines 4-10), the etchant does not etch layer 18 (fig. 6), which reads on the etchant is selective to the layer 18/etch stop layer

making electrical contact to the devices through the opening (col 6, lines 45-50)

Unlike the instant claimed inventions as per claims 11, 20, Yang fails to expressly disclose using an aluminum oxide etch stop layer

Song discloses a method for forming a semiconductor device comprises the step of forming an etch stop layer of SiN, aluminum oxide (col 4, lines 22-24)

One skilled in the art at the time the invention was made would have found it obvious to modify Yang method by forming an aluminum oxide etch stop layer as per Song because Song discloses that the etch stop layer is preferably made of an aluminum oxide layer, a SiN layer (col 4, lines 20-22)

Yang also fails to specifically disclose that the flow rate of the carbon oxide is greater than about 80 sccm

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Tomioka discloses a method for generating plasma used for etching comprises the step of using a mixture of fluorocarbon and carbon oxide (flow rate 200 sccm) (col 16, lines 25-27)

Since Yang is concerned with the step of etching substrate/layer 20 of oxide, one skilled in the art at the time the invention was made would have found it obvious to modify Yang method by using an etching mixture of fluorocarbon and carbon oxide having the flow rate as per Tomioka because Tomioka discloses that a gas mixture of fluorocarbon and CO (flow rate 200 sccm) is used as the etching gas for oxide film etching (col 16, lines 22-26)

The limitations of claims 12-14, 18 have been discussed above

4. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fitch et al (US 5,324,683) in view of Song et al (US 6,713,310) and further in view of Tomioka et al (US 5,897,713)

Fitch discloses a method for forming a semiconductor structure. The method comprises the steps of:

providing a substrate having an etch stop layer located thereunder (col 11, lines 20-23)

etching an opening in the substrate using an etchant comprising a carbon oxide, CF<sub>4</sub>/fluorocarbon, nitrogen/an etch rate modulator and an inert carrier gas (col 9, lines 5-27), the etchant does not etch layer 38 (fig. 22), which reads on the etchant is selective to the layer 18/etch stop layer

Unlike the instant claimed invention as per claim 7, Yang fails to expressly disclose using an aluminum oxide etch stop layer

Song discloses a method for forming a semiconductor device comprises the step of forming an etch stop layer of SiN, aluminum oxide (col 4, lines 22-24)

One skilled in the art at the time the invention was made would have found it obvious to modify Yang method by forming an aluminum oxide etch stop layer as per Song because Song discloses that the etch stop layer is preferably made of an aluminum oxide layer, a SiN layer (col 4, lines 20-22)

Fitch also fails to specifically disclose that the flow rate of the carbon oxide is greater than about 80 sccm

Tomioka discloses a method for generating plasma used for etching comprises the step of using a mixture of fluorocarbon and carbon oxide (flow rate 200 sccm) (col 16, lines 25-27)

Since Fitch is concerned with the step of etching substrate/layer 30 of oxide, one skilled in the art at the time the invention was made would have found it obvious to modify Yang method by using an etching mixture of fluorocarbon and carbon oxide having the flow rate as per Tomioka because Tomioka discloses that a gas mixture of fluorocarbon and CO (flow rate 200 sccm) is used as the etching gas for oxide film etching (col 16, lines 22-26)

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5. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fitch et al (US 5,324,683) in view of Song et al (US 6,713,310) and further in view of Tomioka et al (US 5,897,713)

Fitch discloses a method for forming a semiconductor structure. The method comprises the steps of:

- providing semiconductor devices over a semiconductor substrate 12 (fig. 8)

- providing a dielectric layer 30 over the semiconductor device, the dielectric layer having an etch stop layer located thereunder (col 11, lines 20-23)

- etching an opening in the substrate using an etchant comprising a carbon oxide, CF<sub>4</sub>/fluorocarbon, nitrogen/an etch rate modulator and an inert carrier gas (col 9, lines 5-27), the etchant does not etch layer 38 (fig. 22), which reads on the etchant is selective to the layer 18/etch stop layer

- making electrical contact to the devices through the opening (col 13, lines 51-53)

Unlike the instant claimed invention as per claim 17, Fitch fails to expressly disclose using an aluminum oxide etch stop layer

Song discloses a method for forming a semiconductor device comprises the step of forming an etch stop layer of SiN, aluminum oxide (col 4, lines 22-24)

One skilled in the art at the time the invention was made would have found it obvious to modify Yang method by forming an aluminum oxide etch stop layer as per Song because Song discloses that the etch stop layer is preferably made of an aluminum oxide layer, a SiN layer (col 4, lines 20-22)



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Fitch also fails to specifically disclose that the flow rate of the carbon oxide is greater than about 80 sccm

Tomioka discloses a method for generating plasma used for etching comprises the step of using a mixture of fluorocarbon and carbon oxide (flow rate 200 sccm) (col 16, lines 25-27)

Since Fitch is concerned with the step of etching substrate/layer 30 of oxide, one skilled in the art at the time the invention was made would have found it obvious to modify Fitch method by using an etching mixture of fluorocarbon and carbon oxide having the flow rate as per Tomioka because Tomioka discloses that a gas mixture of fluorocarbon and CO (flow rate 200 sccm) is used as the etching gas for oxide film etching (col 16, lines 22-26)

6. Claims 5, 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yang et al (US 6,162,583) in view of Song et al (US 6,713,310) and Tomioka et al (US 5,897,713) and further in view of Tsuchiya (US 2003/0127422A1)

Yang as modified by Song and Tomioka has been described above. Unlike the instant claimed inventions as per claims 5,15, Yang, Song and Tomioka fail to disclose that the ratio of fluorocarbon to oxygen/etch rate modulator is at least 2:1

Tsuchiya discloses a method for high selectivity etching comprises the step of using an etching gas mixture having a the ratio of fluorocarbon to oxygen/etch rate modulator of 2:1 (col 3, paragraph 0037)

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Hence, one skilled in the art at the time the invention was made would have found it obvious to modify Yang, Song and Tomioka by using an etching gas mixture having a ratio of fluorocarbon to oxygen of 2:1 as per Tsuchiya because Tsuchiya discloses that the fluorocarbon/oxygen is more important in the process and the preferred FC/O<sub>2</sub> is from 2:1 to 3:1 (col 3, paragraph 0037)

### ***Allowable Subject Matter***

7. Claims 6, 16 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

### ***Response to Arguments***

8. Applicant's arguments filed 12/19/2006 have been fully considered but they are not persuasive.

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning to combine Yang with Song and Tomioka, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

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In response to applicant's argument that there is no suggestion to combine the references of Yang with Song because none of the references acknowledges the benefits of using the aluminum oxide etch stop layer as an etch stop layer and using an etchant that uses a flow rate of CO greater than 80 sccm, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, while it is true that Song does not acknowledge the benefits of using the aluminum oxide etch stop layer as an etch stop layer, it is also true that Song clearly discloses that the etch stop layer is preferably made of an aluminum oxide layer, a SiN layer (col 4, lines 20-22), which can be used as a motivation to incorporate Song teaching with Yang method that using an etch stop layer 18 of SiN. Thus, one skilled in the art would have found it obvious to combine the teaching of Yang and Song to produce the claimed invention. In addition, while it is true that Tomioka does not acknowledge the benefits using an etchant that uses a flow rate of CO greater than 80 sccm, it is also true that Tomioka discloses that it is conventional in the art to use an etchant that uses a flow rate of CO greater than 80 sccm and "It has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980)

Based on the above reasons, the examiner maintains the rejection(s) of claims 1-5, 7-15, 17-21 under 35 U.S.C 103(a)

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

### ***Conclusion***

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan Vinh whose telephone number is 571 272 1471. The examiner can normally be reached on M-F 8:30-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571 272 1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to be 'LV' followed by a stylized flourish.

LV

March 2, 2006